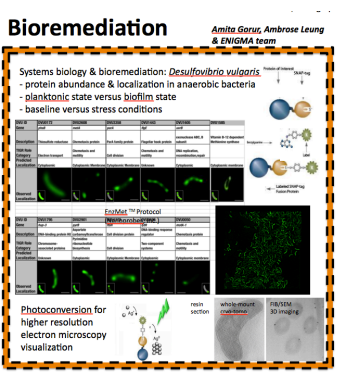
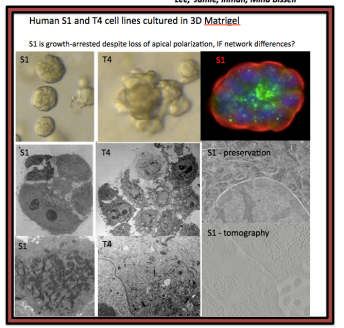


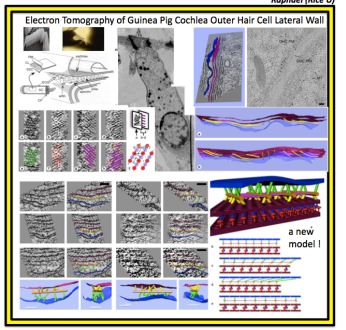
Manfred Auer, LBNL, Life Science Division

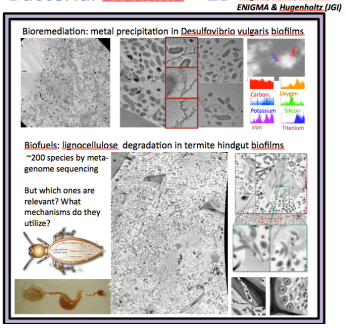
Multiscale Imaging of biological processes

From macromolecules to cells,
tissues and microbial communities

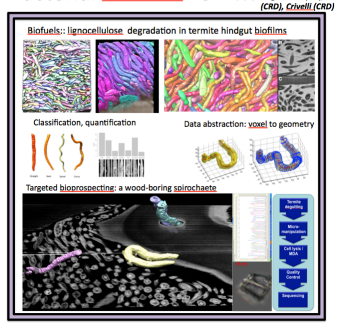


Aim: understand DOE & NIH relevant biological processes through advanced 3D imaging: neuroscience, developmental biology, physiology, cell biology, microbiology

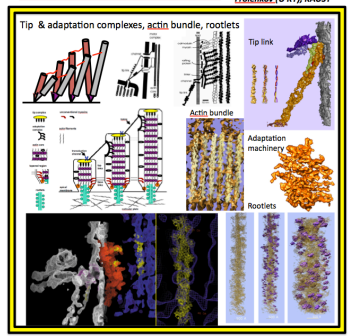




Now possible to collect 32,000 x 32,000 x 10,000 voxel 3D data at 5 nm resolution, ~18 TB of data covering 150 x 150 x 50 microns about. the diameter of a zebrafish embryo



Imaging of the future will create enormous data bases (multichannel 3D maps) that need to be available to the scientific community for collective multidiscipline team data mining and modeling.



Vision: Create Spatiotemporal Maps on the Terrabyte and possibly Petabyte scale for biological processes to which encyclopedic knowledge can be linked for real time exploration and intuitive understanding of biological processes:

Assumption: The human brain is not wired to comprehend text-string/excel-sheet based data bases, otherwise we would never have to travel to a city, we would just study the phone book. Instead we prefer to walk across the city and explore its spatio-temporal makeup in order "get" its inner workings.

What tools will we need?

- interactive visualization (immersive visualization = "boots on the ground"), possibly simultaneous from different parts of the world, only small portions of the maps will be needed for display, but real time exploration may be needed, hence constant recalculation of scenery to be visualized
- feature extraction – user initiated, computer-driven (user picks what is of interest, the computer makes it happen)
- data simplification – CAD model building (from voxels to objects to understanding), "Pixar Studios on stereoids"
- geometrical quantification, statistics
- behavior prediction/modeling -> iterative process : not unlike engineering

TURN BIOLOGY INTO A QUANTITATIVE ENGINEERING DISCIPLINE !!!!!!!!!!!!!!!